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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/511,927	05/06/2006	Maolin Long	H0678.70011US00	2021

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EXAMINER	
FLORES, LEON	
ART UNIT	PAPER NUMBER
2611	
MAIL DATE	DELIVERY MODE
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/511,927	LONG, MAOLIN	
	Examiner	Art Unit	
	LEON FLORES	2611	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *18 October 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-10* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-4 and 10* is/are rejected.

7)☒ Claim(s) *5-9* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *18 October 2004* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Drawings

1. Figures (1-2) should be designated by a legend such as ***--Prior Art--*** because only that which is old is illustrated. See MPEP § 608.02(g). Corrected drawings in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Objections

1. Claims (4, 6, 7) are objected to because of the following informalities: Applicant should define what the boxes mean. Appropriate correction is required.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claims (1-10) are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 1 recites the limitation of "the neural network model" in line 5, "the expected output value" in line 7, "the specified criterion" in line 10. There is insufficient antecedent basis for this limitation in the claim. Claims 2-10 depend on claim 1.

Regarding claim 2, the phrase "for example" renders the claim indefinite because it is unclear whether the limitation(s) following the phrase are part of the claimed invention. See MPEP § 2173.05(d). Claims 3-10 depend on claim 2.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

6. **Claims (1-4) are rejected under 35 U.S.C. 103(a) as being unpatentable over Hua Qian et al (hererinafter Hua) "A Neural Network Predistorter For Nonlinear Power Amplifiers with Memory" IEEE 2002 in view of Changsoo Eun et al (hereinafter Eun) "Utilization of Neural Network Signal Processing in the Design of a Predistorter for a Nonlinear Telecommunication Channel" IEEE 1994.**

Re claim 1, Hua discloses a BDPD-based (Base-band Digital Pre-Distortion) method for improving efficiency of RF power amplifier, comprising: (1) Determining structural parameters of a neural network as required and establishing the neural

network, inputting modeling data and initial values of network parameters required for establishing the neural network model of the RF power amplifier (See section 2); (2) Propagating forward with the input data and network parameters, calculating the difference between output value of the neural network and the expected output value, then propagating backward along the neural network with said difference to correct the network parameters (See section 2); (4) Solving the pre-distortion algorithm of the RF power amplifier with said neural network model (See section 2); (5) Carrying out pre-distortion processing for input signal of the RF power amplifier with said pre-distortion algorithm and then feeding them to the RF power amplifier. (See section 2)

But the reference of Hua fails to explicitly teach (3) Determining whether said difference meets the specified criterion; if so, outputting the neural network model of the RF power amplifier and going to step (4), otherwise inputting the corrected network parameters to the neural network and going to step (2).

However, Eun does. (See section 2 "training session") Eun discloses a Neural network signal processing in the design of a Predistorter wherein suggesting the teaching of (3) Determining whether said difference meets the specified criterion; if so, outputting the neural network model of the RF power amplifier and going to step (4) ("after training network A is removed from system and the predistorter alone works as a nonlinear compensater"), otherwise inputting the corrected network parameters to the neural network and going to step (2).("the overall output should approach the input as closely as possible, the error approaches the optimum value")

Therefore, taking the combined teaching of Hua and Eun as a whole, it would have been obvious to one of ordinary skills in the art to incorporate this feature into the system of Hua, in the manner as claimed and as taught by Eun, for the benefit of designing the neural network predistorter.

Re claim 2, the combination of Hua and Eun further suggests that wherein said structural parameters comprise: the number n of delay items of input signal, the number r of neural elements on each layer of the neural network, the number m of layers of the neural network; said modeling data comprises: output signal Y(KT), input signal, and delay items of input signal of the power amplifier; said network parameters comprise: weight Wijk and bias bij; said output signal Y(KT) of the RF power amplifier is the expected output value corresponding to the input signal, i.e., the actual output value of the RF power amplifier corresponding to the input signal. (In Hua, see section 2)

Re claim 3, the combination of Hua and Eun further suggests that wherein said input signal and said delay items of the input signal are base-band digital signal amplitude X(KT) of the power amplifier and delay items thereof X[(K-1)T] . . . X[(K-n+1)T], respectively. (In Hua, see section 2)

Re claim 4, the combination of Hua and Eun further suggests that wherein the number n of delay items of input signal is: $1<n<10$, the number r of neural elements on

each layer of the neural network is: 1<r<10, the number m of layers of the neural network is: 1<m<10. (In Hua, see section 2)

7. **Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hua Qian et al (hererinafter Hua) "A Neural Network Predistorter For Nonlinear Power Amplifiers with Memory" IEEE 2002 and Changsoo Eun et al (hereinafter Eun) "Utilization of Neural Network Signal Processing in the Design of a Predistorter for a Nonlinear Telecommunication Channel" IEEE 1994, as applied to claim 1 above, and further in view of O'Flaherty et al (hereinafter O'Flaherty) (US Patent 6,703,897 B2)**

Re claim 10, the combination of Hua and Eun fails to explicitly teach that wherein the bandwidth of said input signal is wider than that of actual input signal of RF power amplifier.

However, O'Flaherty does. (See fig. 3: 26, 28 & col. 4, lines 19-50) O'Flaherty discloses a predistorter wherein suggesting that wherein the bandwidth of said input signal is wider than that of actual input signal of RF power amplifier. (Since there are two mathematical models (phase and amplitude) used in order to compensate for distortion, the bandwidth of the input signal must be wider.)

Therefore, taking the combined teaching of Hua and Eun as a whole, it would have been obvious to one of ordinary skills in the art to incorporate this feature into the system of Hua, as modified by Eun, in the manner as claimed and as taught by O'Flaherty, for the benefit of providing compensation in both amplitude and phase.

8. **Claim 1 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hua Qian et al (hererinafter Hua) "A Neural Network Predistorter For Nonlinear Power Amplifiers with Memory" IEEE 2002 in view of Song et al. (hereinafter Song) (US Patent 7,333,559 B2)**

Re claim 1, Hua discloses a BDPD-based (Base-band Digital Pre-Distortion) method for improving efficiency of RF power amplifier, comprising: (1) Determining structural parameters of a neural network as required and establishing the neural network, inputting modeling data and initial values of network parameters required for establishing the neural network model of the RF power amplifier (See section 2); (2) Propagating forward with the input data and network parameters, calculating the difference between output value of the neural network and the expected output value, then propagating backward along the neural network with said difference to correct the network parameters (See section 2); (4) Solving the pre-distortion algorithm of the RF power amplifier with said neural network model (See section 2); (5) Carrying out pre-distortion processing for input signal of the RF power amplifier with said pre-distortion algorithm and then feeding them to the RF power amplifier. (See section 2)

But the reference of Hua fails to explicitly teach (3) Determining whether said difference meets the specified criterion; if so, outputting the neural network model of the RF power amplifier and going to step (4), otherwise inputting the corrected network parameters to the neural network and going to step (2).

However, Song does. (See figs. 2-3 & col. 7, lines 20-23, col. 8, lines 4-32) Song discloses a digital Predistorter wherein suggesting the teaching of (3) Determining

whether said difference meets the specified criterion; if so, outputting the neural network model of the RF power amplifier and going to step (4) ("LUT convergence"), otherwise inputting the corrected network parameters to the neural network and going to step (2). ("LUT convergence")

Therefore, taking the combined teaching of Hua and Song as a whole, it would have been obvious to one of ordinary skills in the art to incorporate this feature into the system of Hua, in the manner as claimed and as taught by Song, for the benefit of providing compensation.

Allowable Subject Matter

9. Claims (5-6 & 7-9) are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

10. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

- Kim et al (US Patent 6,956,433) discloses a polynomial pre-distorter.
- Yang et al (US Publication 2003/0207680 A1) discloses a pre-distortion system wherein a training phase occurs.
- Opas et al (US Patent 6,928,122 B2) discloses an amplifier pre-distortion system wherein a training phase occurs.
- Cavers et al (US Patent 6,734,731 B2) discloses a self-calibrated power amplifier.

- White et al (US Publication 2005/0024138 A1) discloses a pre-distorter for phase modulated signals with low peak to average ratios.

Contact

Any inquiry concerning this communication or earlier communications from the examiner should be directed to LEON FLORES whose telephone number is (571)270-1201. The examiner can normally be reached on Mon-Fri 7-5pm Alternate Fridays off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Payne can be reached on 571-272-3024. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/L. F./
Examiner, Art Unit 2611
April 3, 2009

/David C. Payne/

Supervisory Patent Examiner, Art Unit 2611